

Draft

Strategic Plan

2004 - 2009



Trinity River Restoration Program



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Photo of a map file

Purpose of the Strategic Plan

What will the Trinity River and its fisheries look like in five years? What will be the measure of success for the Trinity River Restoration Program (TRRP)? Can salmon and steelhead populations truly be restored to historic levels? This Strategic Plan, as a fundamental part of the adaptive environmental assessment and management (AEAM) process, helps us answer those questions. It sets out specific goals and objectives, and it establishes measurable performance targets. It focuses on results: outcomes rather than outputs, and it will be the basis for testing hypotheses, setting work priorities, developing annual budgets and evaluating annual accomplishments. By itself, it is just a theoretical exercise. If it reflects a shared vision by all Program partners, this framework will produce measurable results that make a difference. It is intended to give a clear picture of our hopes, expectations, and ambitions for the future. Above all, it is an iterative process where we will learn and improve.

There are many river and fishery restoration programs throughout the United States, with varying goals and objectives. The TRRP is characterized by its AEAM foundation. Although the recommendations of the 1999 Trinity River Flow Evaluation Study (TRFES) were based on the best available scientific information compiled by respected scientists and peer reviewed by outside experts, the fact remains that alluvial river systems are complex and dynamic. Our understanding of these systems and our predictive capabilities are extensive and improving, but some uncertainties still exist. More detailed planning efforts, such as the Scientific Framework¹ will identify and address these knowledge gaps.

The purpose of this first Strategic Plan of the TRRP is not merely to outline a series of well-intentioned fishery restoration actions, but to set the stage for better informed decision-making. The basic premise of the TRFES is that significant increases in naturally spawning anadromous fish populations can only be achieved by substantially increasing rearing habitat. Increased habitat can be created by a combination of actions involving managed flows, channel restoration, and sediment management that result in "healthy river attributes". The AEAM process is a structured mechanism for fine-tuning management recommendations for these interrelated actions and comparing predicted results with actual outcomes. The hierarchy outlined in this Plan - broad program authorities, mission statement, strategic goals, and specific objectives – leads to numerical measures that help us evaluate Program accomplishments.

¹ The Scientific Framework is a comprehensive and systematic methodology that emphasizes learning from the outcomes of carefully designed management actions as a continuing process. With the Strategic Plan providing the basic sideboards, the Framework will lead to the development of a conceptual model of the Trinity River system and its resources (refer to Figure A-1, Appendix A). The conceptual model will include the following six features: 1) system sub-models, 2) measurable indicators of progress towards the goals and objectives of each sub-system, 3) an integrated spatial structure for all sub-model, 4) functional physical-biological linkages among the sub-models, 5) chains of hypotheses linking actions to indicators, and 6) critical uncertainties and knowledge gaps.

Primary justification for the TRRP is found in Public Law (P.L.) 84-386, Trinity River Division (TRD), Central Valley Project, August 12, 1955, where "...the Secretary is authorized and directed to adopt appropriate measures to insure the preservation and propagation of fish and wildlife..." This is further supported in P.L. 98-541, the Trinity River Basin Fish and Wildlife Management Act of 1984, as amended, wherein "...the Secretary...shall formulate and implement a fish and wildlife management program for the Trinity River Basin designed to restore the fish and wildlife populations in such basin to the levels approximating those which existed immediately before the start of construction...and to maintain such levels." Most recently, P.L. 102-575, the Central Valley Project Improvement Act, Title 34, reiterated this emphasis where "...the purposes of this title shall be...to protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California..."

The Record of Decision (ROD) for the Trinity River Mainstem Fishery Restoration Environmental Impact Statement/Report (EIS/EIR) was signed on December 19, 2000. The decision was contested, and a Supplemental EIS/EIR (SEIS) has been required by U.S. District Court to resolve the deficiencies. Recent U.S. District Court rulings (December 9, 2002 and April 7, 2003) reiterate that the mission of the TRRP is to restore and maintain the natural production of anadromous fish in the Trinity River basin downstream of Lewiston Dam to pre-Trinity River Division levels. The court goes on to emphasize the U.S. Government's tribal trust obligations, and the need to meet other restoration goals of Public Law 98-541, as amended. The SEIS is presently scheduled for completion by December 2004. The issue of allowable flow releases is unlikely to be resolved before that date. In the interim, the Program is required to comply with direction in court rulings and orders, including that of being allowed to proceed with all non-flow related actions.

Consistent with the above authorities and decisions, it is appropriate that the TRRP take a long-term and system-wide view of restoration. This is expressed in the following mission statement:

"The mission of the Trinity River Restoration Program is to restore, enhance, and conserve naturally-spawning anadromous fish, native plant communities, and associated wildlife resources of the Trinity River basin in sufficient quantity and quality to ensure long-term sustainability."

This requires successful application of the many different tools: variable annual flow regimes based on water year type; mechanical channel rehabilitation; sediment management; watershed restoration; infrastructure improvement; adaptive environmental assessment and management. Together they represent an integrated approach for restoration.

While all of these actions apply to the long-term mission, the Program also needs a short-term focus to implement the ambitious objectives outlined in the ROD and TRFES recommendations (TRFES; Chapter 8, Appendix O). To do so, this initial Strategic Plan

will emphasize mainstem activities occurring in the 40 mile reach from Lewiston Dam to the confluence with the North Fork Trinity River. After the initial five years (2004-2009), or sooner if other circumstances dictate, the Strategic Plan will be revisited and objectives modified or refocused if necessary.

Desired Future Conditions

In order to set appropriate goals and objectives for the first five years of the Strategic Plan, it is important to describe and agree upon what we want the Trinity River and its anadromous fisheries to look like, i.e., their desired future condition. The following "word pictures", written in the present tense, provide useful snapshots of what we hope will exist at three different points in the future. This, in turn, allows us to describe steps needed to reach those conditions.

April 2005²

The initial TRRP Strategic Plan (2004-2009) has been completed for a year, and is being used to guide development of the Scientific Framework, set project priorities, and identify funding needs (budgets). Outcomes of the Scientific Framework are being incorporated into annual programs of work. The process for developing and recommending flow release schedules by water-year type is well understood, agreed to by all program partners, and working effectively. The FY 2006 budget process is substantially based on Strategic Plan objectives and Scientific Framework priorities, including an emphasis on integrated study design and independent technical reviews. A comprehensive watershed restoration strategy is complete, along with the Rush Creek watershed assessment. The coarse sediment portion of the sediment management plan is complete, and permits have been obtained for implementation in the summer of 2005.



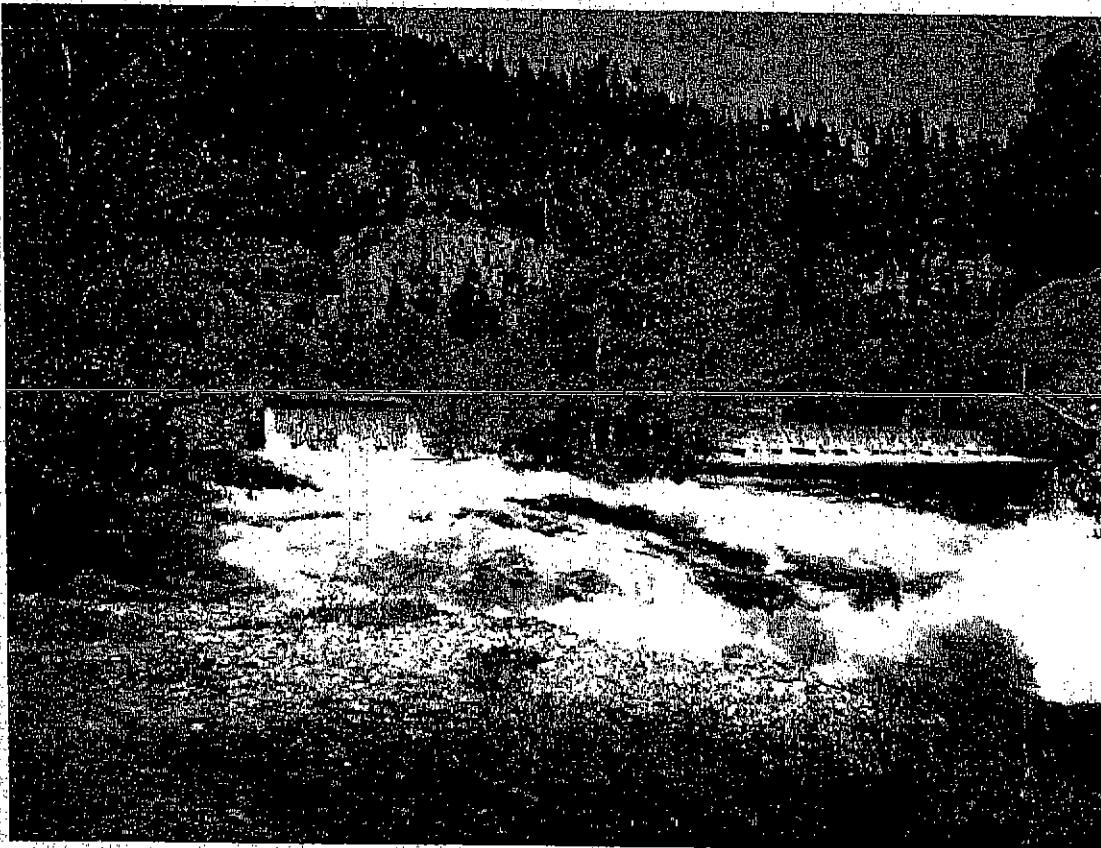
Four bridges have been modified to allow for higher peak flows, and are now open to traffic. Following completion of other floodplain infrastructure improvements, flow schedules are now being developed that incorporate peak releases of up to 11,000 cfs, depending on water year type. The Hocker Flat pilot restoration site is complete. The design and permitting process has been standardized and streamlined, and is being applied to other channel restoration sites. All landowners (private, state, and federal) are

² Although the TRRP office opened in September 2002 and this planning process was initiated in March 2003, the current date of April 2004 is used as the reference point for 1, 3, and 5 year vision statements.

aware of the program and actively participating in project planning and design. Support from local communities is visible and increasing as the result of public outreach efforts.

April 2007

Unconstrained implementation of the new ROD (resulting from the SEIS) is taking place, with the ability to fully develop flow schedules for all water year types. A comprehensive AEAM plan is in place, and the second year's recommendations are being implemented. Information gaps have been identified, additional studies have been identified and proposals solicited for review by an independent technical panel.



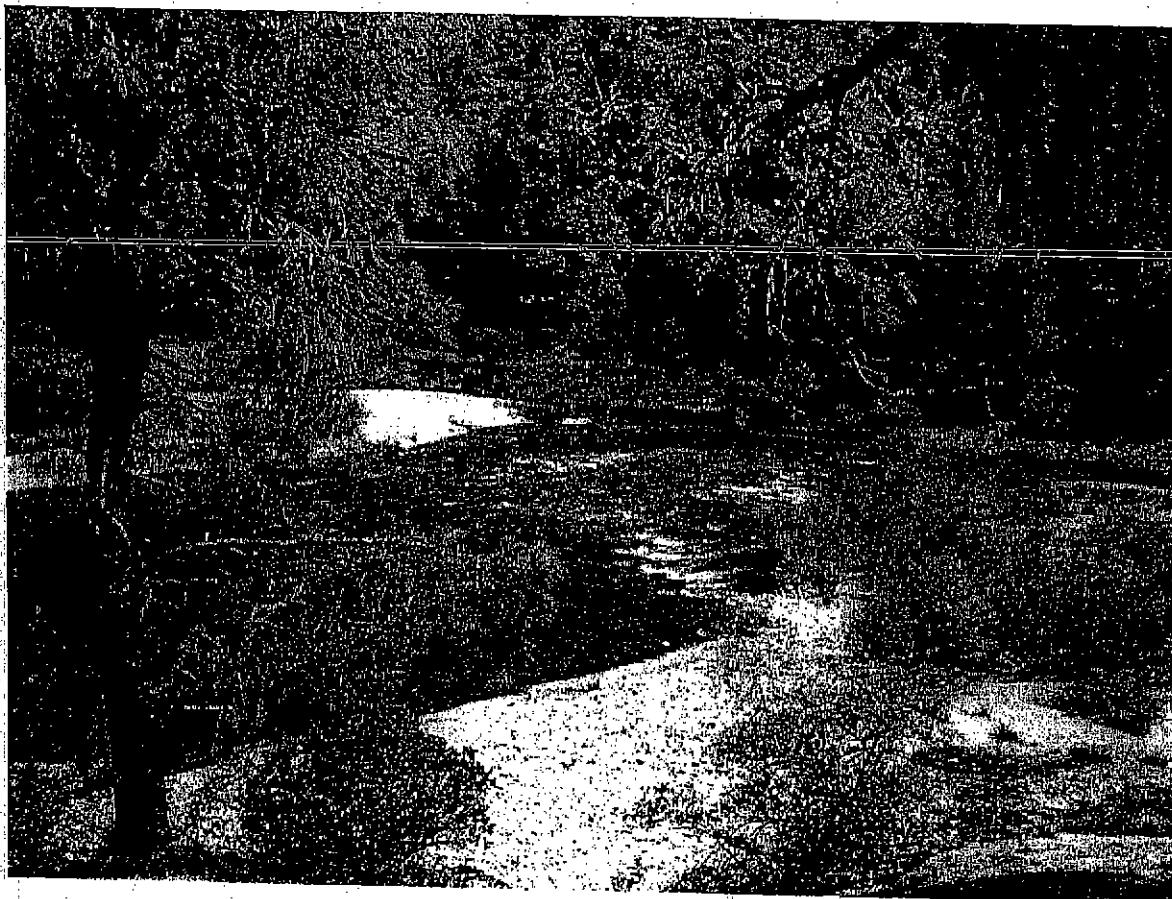
Predictive modeling is routinely used in flow scheduling and for planning and design of restoration sites. A functional information management system and decision support tools (models) are in place and being used. Consistent science-based protocols for all elements of the restoration process have been developed. A systematic evaluation by the Science Advisory Board of over-all program effectiveness has been completed.

Biological site responses at individual gravel introduction and restoration projects (e.g., Diversion Pool, Cableway, and Hocker Flat) are becoming visible and being documented. All five channel rehabilitation sites below Canyon Creek are complete. Design and permitting actions for an additional 19 channel rehabilitation sites are well underway, with construction scheduled for 2008. A significant portion of the short term coarse

sediment introduction program is complete. The watershed restoration strategy is in place, and all tributaries between Lewiston Dam and the North Fork Trinity River have been assessed and priorities established, including those with direct relevance to mainstem restoration activities (i.e., fine sediment source control).

April 2009

The Trinity River is beginning to change its configuration because of managed annual variable flow releases, substantial gravel introductions, and implementation of 24 bank rehabilitation projects. These channel restoration projects and habitat features are self maintaining, and are starting to create visible system-wide changes. Projects have started to link up; holes are being created and/or filling in, more scour is visible, and the channel is beginning to move. The first of replacement riparian plantings are showing significant growth, and the greater diversity of vegetation is improving quality of wildlife habitat.



Because of their 3-5 year life cycle, 2009 is the first opportunity to observe increases in overall fish populations. Positive responses to higher flows and implementation of restoration projects are being documented, and studies are producing quality data that can be used to guide adaptive management of flow schedules and restoration site design in a scientifically defensible manner. There is a common perception is that we have made a positive difference in the river and dependent fish populations.

Program Goals and Objectives

LONG-TERM PROGRAM MISSION STATEMENT	
<i>"The mission of the Trinity River Restoration Program is to restore, enhance, and conserve naturally-spawning anadromous fish, native plant communities, and associated wildlife resources of the Trinity River basin in sufficient quantity and quality to ensure long-term sustainability."</i>	
SHORT-TERM GOAL 2004-2009	PRIMARY OBJECTIVES ¹ 2004-2009
	<p>Restore natural populations of anadromous fish (adults and juveniles) in the Trinity River basin below Lewiston Dam to levels that existed prior to the construction of Trinity and Lewiston dams for that same reach, and maintain such levels while allowing for appropriate levels of tribal, commercial, and recreational harvest.</p>
	<p>Restore attributes of a healthy, functional alluvial river system to the Trinity River basin downstream of Lewiston Dam to enhance populations of native fish species.</p>
	<p>Complete infrastructure modifications needed for wet (8,500 cfs) and extremely wet (11,000 cfs) water year flows as soon as possible. (designs, permits, contracts)</p> <ul style="list-style-type: none"> • Implement bridge modifications by April 2005. • Implement other floodplain structure modifications by April 2005.
KEY STRATEGIES ² And Tasks	<p>Implement a managed variable annual flow regime based on water year type.</p> <ul style="list-style-type: none"> • Maximize flow-related benefits for channel rehabilitation sites and sediment management. <p>Minimize impacts to and mitigate for alteration of riparian and associated upland plant communities resulting from channel restoration activities within the historic floodplain.</p> <p>Address problems of excessive sediment input from tributaries, including the South Fork Trinity River, resulting from land use practices. (plans, reports)</p> <p>Consider physical, biological, and legal issues in setting watershed priorities.</p> <p>Participate in a watershed restoration coordination group to encourage multi-agency efforts and their various objectives.</p> <p>Use, develop and provide credible and objective scientific knowledge that furthers our understanding of anadromous fish, regulated alluvial river systems and related resources for effective adaptive management of the Trinity River.</p> <p>Develop and implement a scientific framework that tiers to the TRFES and clearly identifies an integrated conceptual model of the Trinity River system (and submodels), measurable indicators of progress, physical and biological linkages and related hypotheses, and critical uncertainties or knowledge gaps.</p> <p>Test hypotheses and reduce management uncertainties by using best available science in implementing flow schedules, channel restoration activities, sediment management, and watershed restoration within the context of predetermined study designs outlined in the scientific framework.</p> <p>Evaluation Report. (acres, shoreline miles treated)</p> <p>Prevent reestablishment of riparian vegetation from channel margins by implementing annual flow schedules. (average age of new growth)</p> <ul style="list-style-type: none"> • Establish a riparian revegetation capability to acquire/develop native plant materials needed for restoration activities.

¹ These objectives will be refined and supplemented as the Scientific Framework for the program is developed.
² Specific management targets from the TRFE are identified in Appendix B.

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SHORT-TERM GOAL 2004-2009	PRIMARY OBJECTIVES 2004-2009	IMPLEMENTATION STRATEGY 2004-2009	MONITORING AND EVALUATION 2004-2009
Restore natural populations of anadromous fish (adults and juveniles) in the Trinity River basin below Lewiston Dam to levels that existed prior to the construction of Trinity and Lewiston dams for that same reach, and maintain such levels while allowing for appropriate levels of tribal, commercial, and recreational harvest.	Restore attributes of a healthy, functional alluvial river system to the Trinity River basin downstream of Lewiston Dam to enhance populations of native fish species.	Implement restoration activities within tributary watersheds that provide direct benefits to mainstem health and function.	Use, develop and provide credible and objective scientific knowledge that furthers our understanding of anadromous fish, regulated alluvial river systems and related resources for effective adaptive management of the Trinity River.
KEY STRATEGIES ² And Tasks (Continued)	Implement a managed variable annual flow regime based on water year type. (Continued) • Optimize potential biological response when developing and implementing annual flow recommendations (see Appendix B). (temperature, smolt residence time, size, decrease in episodic adult mortality) • Use species-specific biological production and population models, e.g., degree-day model for riparian seed release. • Establish real-time instrumentation to track environmental conditions.	Minimize impacts to and mitigate for alteration of riparian and associated upland plant communities resulting from channel restoration activities within the historic floodplain.	Incorporate Science Advisory Board review and oversight to ensure program credibility and effectiveness. Emphasize the scientific peer review process in all monitoring, assessment, and research aspects of the Program. <ul style="list-style-type: none">• Map distribution of riparian and associated upland vegetation to predict and quantify the extent and quality of wildlife habitat for at-risk species.• Develop base-line ecological data for monitoring native at-risk aquatic, riparian and associated upland wildlife species and critical habitat requirements.• Provide favorable range/timing of flows to maintain macroinvertebrate habitat within juvenile salmonid rearing habitat.

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	Implement restoration activities within tributary watersheds that provide direct benefits to mainstem health and function.	Minimize impacts to and mitigate for alteration of riparian and associated upland plant communities resulting from channel restoration activities within the historic floodplain.	
	Increase geomorphic and hydraulic complexity to provide greater diversity of habitat capable of supporting a wide range of life history stages.	Identify additional opportunities for wetland and riparian conservation, enhancement and rehabilitation within the Trinity River basin that are consistent with the primary goal of the program. (plans, reports)	
	• Plan, design, and implement five mechanical channel restoration projects below Canyon Creek by 2006.	• Restore and enhance riverine wetlands and existing side channels to increase overall use as high flow and summer thermal refugia for juvenile fish, amphibians, and other associated species.	
	(designs, permits, contracts)		
	• Plan, design, and implement the remaining 19 Phase 1 mechanical channel restoration projects by 2008. (designs, permits, contracts)		
		KEY STRATEGIES ² And Tasks (Continued)	

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Program Goals and Objectives

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SHORT-TERM GOAL 2004-2009	PRIMARY OBJECTIVES! 2004-2009	IMPLEMENTATION STRATEGY	MEASUREMENT
Restore natural populations of anadromous fish (adults and juveniles) in the Trinity River basin below Lewiston Dam to levels that existed prior to the construction of Trinity and Lewiston dams for that same reach, and maintain such levels while allowing for appropriate levels of tribal, commercial, and recreational harvest.	Restore attributes of a healthy, functional alluvial river system to the Trinity River basin downstream of Lewiston Dam to enhance populations of native fish species.	Implement restoration activities within tributary watersheds that provide direct benefits to mainstem health and function.	Minimize impacts to and mitigate for alteration of riparian and associated upland plant communities resulting from channel restoration activities within the historic floodplain.
		<p>Minimize fine sediment delivery and storage of fine bed material in the mainstem.</p> <ul style="list-style-type: none"> • Transport sand out of the reach at a volume greater than input from tributaries to reduce instream sand storage. <p>KEY STRATEGIES² And Tasks (Continued)</p> <ul style="list-style-type: none"> • Monitor sediment collection ponds for efficiency and storage capacity. (% capacity) • Maintain capacity of collection ponds through periodic dredging. (frequency) 	Use, develop and provide credible and objective scientific knowledge that furthers our understanding of anadromous fish, regulated alluvial river systems and related resources for effective adaptive management of the Trinity River.

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² Specific management targets from the TRFE are identified in Appendix B.

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PRIMARY OBJECTIVES ¹ 2004-2009	<p>Restore attributes of a healthy, functional alluvial river system to the Trinity River basin downstream of Lewiston Dam to enhance populations of native fish species.</p>	<p>Implement restoration activities within tributary watersheds that provide direct benefits to mainstem health and function.</p>	<p>Minimize impacts to and mitigate for alteration of riparian and associated upland plant communities resulting from channel restoration activities within the historic floodplain.</p>
KEY STRATEGIES ² And Tasks (Continued)	<ul style="list-style-type: none"> • Balance the coarse sediment budget in the mainstem. • Monitor sediment transport and delta conditions by substrate sampling, pool size. (tons) • Develop, refine, and apply a predictive sediment transport model for use in annual flow recommendations and long-term gravel injections. (model completed, calibrated) • Transport coarse bed material at a rate near equal to input from tributaries to route coarse sediment, create alluvial deposits, and eliminate tributary aggradation. (tons) • Develop a comprehensive management plan to address short and long-term needs, delta maintenance, and cost. (Plans) 		

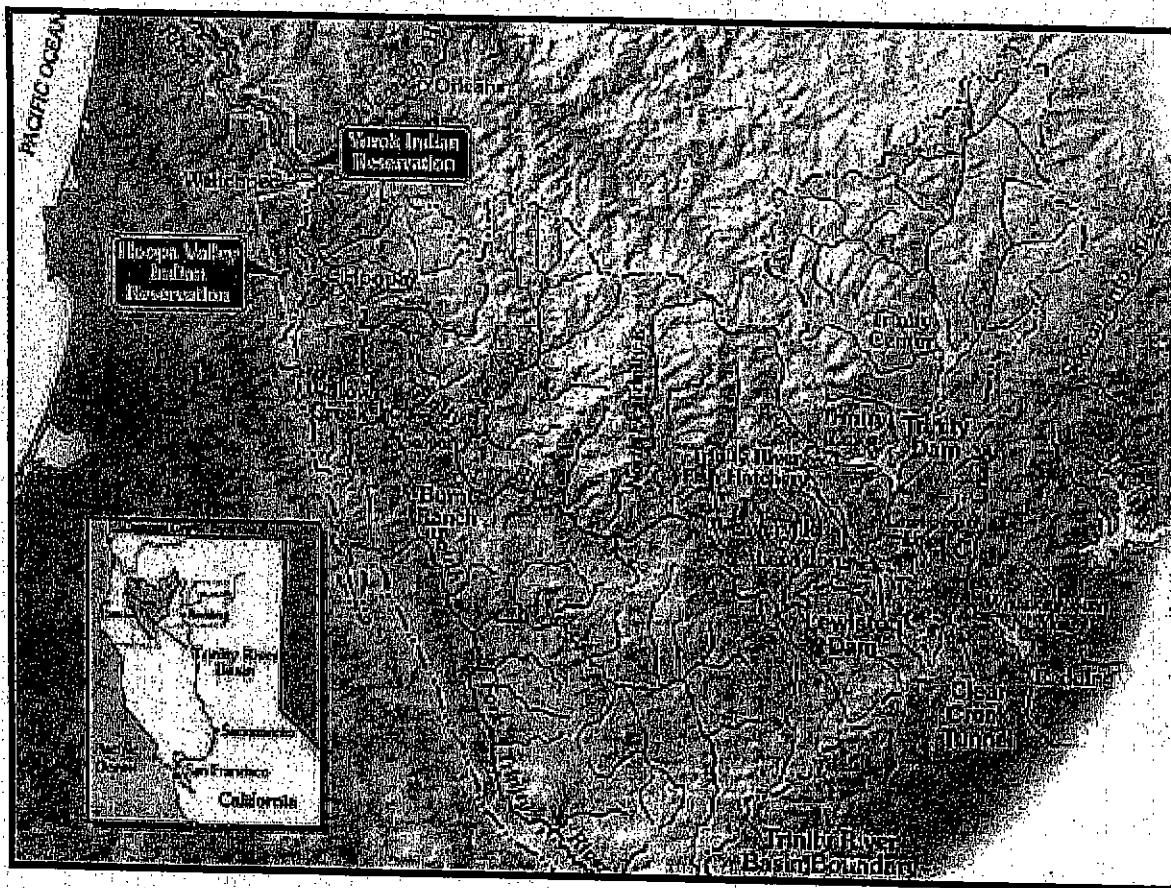
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Appendix A - Resource Overview

The Trinity River Basin

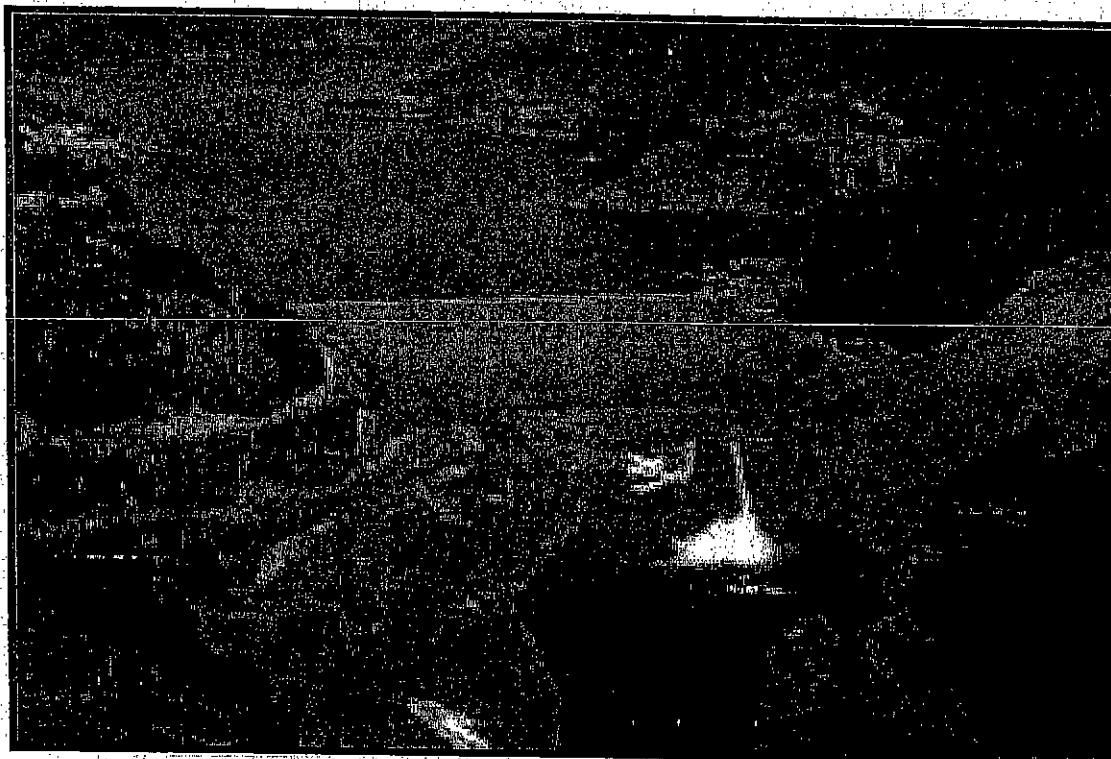
The Trinity River drains a watershed of approximately 2,965 square miles, about one-quarter of which is above Lewiston Dam. Elevations range from 8,888 feet mean sea level (msl) at Sawtooth Mountain in the Trinity Alps to 300 feet msl at the confluence of the Trinity and Klamath Rivers. The climate is Mediterranean with an average precipitation of 62 inches per year; throughout the basin it varies from 30-70 inches annually, which typically occurs as rain in the lower elevations and snow at the higher elevations.



Prior to the completion of the Trinity River Division (TRD), flows in the Trinity River were highly variable, ranging from summer flows of 25 cubic feet per second (cfs) to extreme winter events with instantaneous peak flows greater than 100,000 cfs. The maximum flow recorded at Lewiston was 71,600 cfs in 1955. Annual hydrographs typically followed a seasonal pattern of high winter and spring flows followed by low summer and fall flows. Total annual flow volumes at Lewiston ranged from 0.27 to 2.7 million acre feet (maf), with an average of 1.2 maf.

The Trinity River Division

Construction of the TRD began in 1957 and operation of the Lewiston and Carr powerhouses started in April 1964. The TRD consists of a series of dams, tunnels, and power plants that export water from the Trinity River Basin into the Sacramento River Basin. Trinity and Lewiston Dams currently regulate Trinity River flows below River Mile (RM) 112. With a capacity of 2.48 million acre feet (maf), Trinity Reservoir is the largest component of the TRD. Releases from Trinity Reservoir are re-regulated in Lewiston Reservoir prior to release downstream into the Trinity River. Lewiston Reservoir also acts as a forebay for the trans-basin export of water into Whiskeytown Reservoir via the Clear Creek Tunnel. Lewiston Dam marks the upstream limit of anadromous salmonid access.



From 1962 to 1979, the Central Valley Project (CVP) diverted nearly 90 percent of the Trinity River's annual water yield (above Lewiston) into the Sacramento River for agricultural and urban use. After 1979, river releases were increased from 110,000 to 340,000 annual acre feet (afa), such that the diversion percentage was reduced to roughly seventy percent. In recent years (1985-1997), annual exports have decreased to an average of 732,400 AF.

Releases to the Trinity River are currently (April 2004) capped at dry and critically dry years, due to a federal court injunction in December 2002. In critically dry years, the releases are limited to 369,000 AF, while in all other year types (dry, normal, wet, and extremely wet), the releases are limited to 453,000 AF. The original December 19, 2000, Record of Decision (ROD) had provided higher numbers for normal years (647,000 AF),

wet years (701,000 AF), and extremely wet years (815,000 AF). Whether these higher numbers will be reinstated depends on the outcome of the Supplemental EIS (SEIS) and ROD. According to the terms of the CVPIA, long-term flows cannot go lower, regardless of any new ROD, than 340,000 AF. During the past four years, releases have stabilized and increased slightly as shown in the following table:

Year	Volume (acre-feet)
2000	340,000
2001	369,000
2002	469,000
2003	486,000*

*Includes 33,000 acre-feet released in August 2003 to minimize risk of adult salmon mortality in the lower Klamath River.

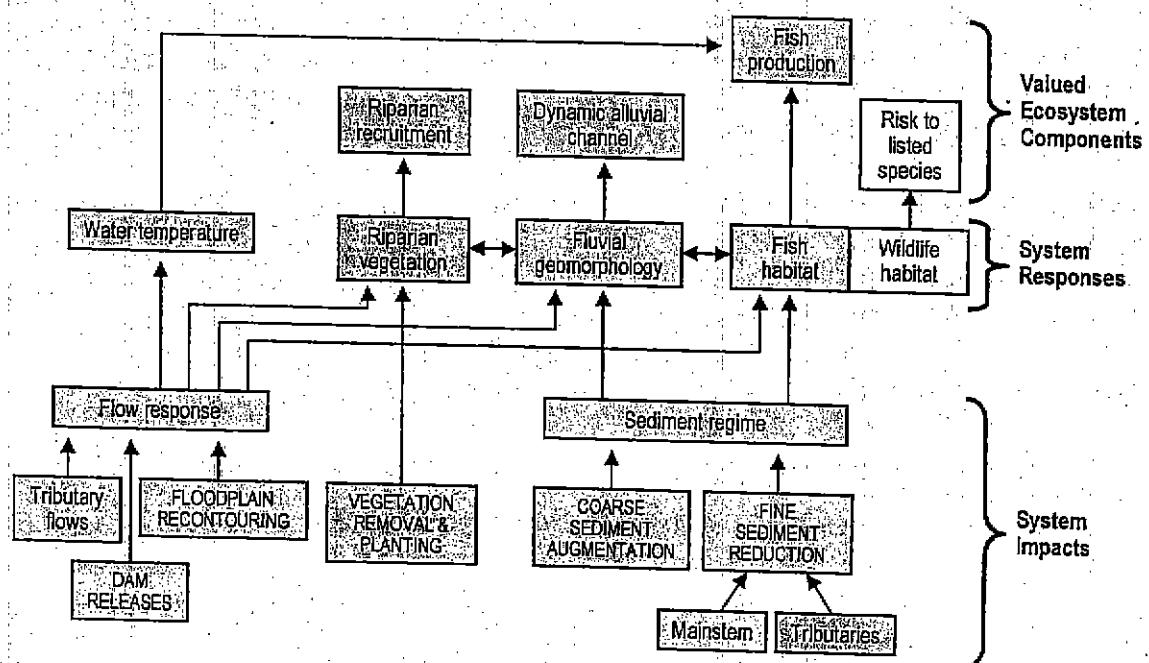
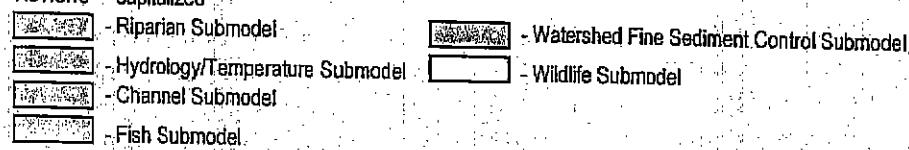
Habitat Relationships

Adequate flows, temperatures, water depths and velocities, appropriate spawning and rearing substrates (e.g., riverbed gravels), and availability of instream cover and food are critical for the production of all anadromous salmonids. Some of the basic relationships are illustrated in the draft conceptual model (Figure A.1). More detailed submodels will be developed for each component.

Figure A.1. Draft conceptual model for Trinity River system.

Legend

ACTIONS - capitalized



A suite of ten attributes was identified in the TRFE Report (USFWS and HVT 1999) and used in the FEIS/EIR (USFWS et al. 2000a) to describe the geomorphic environment and processes of a healthy alluvial river. These attributes provide a foundation for understanding the dynamic equilibrium of the river and developing recommendations to meet restoration objectives, and remain valuable for evaluating potential strategies for improving the fishery within the mainstem Trinity River. The methodology used in the original EIS (USFWS et al. 1999) assumed that if all 10 of these attributes were present, the Trinity River would have the physical characteristics to support a healthy alluvial river ecosystem, and associated anadromous fish habitat. These attributes include:

- Attribute 1. Spatially complex channel geomorphology
- Attribute 2. Flows and water quality are predictably unpredictable
- Attribute 3. Frequently mobilized channel-bed surface
- Attribute 4. Periodic channel-bed scour and fill
- Attribute 5. Balanced fine and coarse sediment budgets
- Attribute 6. Periodic channel migration
- Attribute 7. A functional floodplain
- Attribute 8. Infrequent channel resetting floods
- Attribute 9. Self-sustaining diverse riparian plant community
- Attribute 10. Naturally fluctuating groundwater table

Anadromous Species

The primary fish species of interest to the TRRP include the native anadromous salmonids Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), and steelhead (*Oncorhynchus mykiss irideus*). Of the three species, there are two races of Chinook salmon (spring- and fall-run) and three races of steelhead (summer, fall-, and winter-run), which are differentiated based on the season of migration into the river. All anadromous species begin their life in fresh water, migrate to the ocean to rear and mature, and return to spawn in fresh water. Although the three species have generally similar life histories they differ in the time of year they migrate and spawn, as well as when egg incubation typically occurs.

Spring Chinook salmon and summer steelhead also need long-term adult holding habitat in which pool size and depth, temperature, cover, and proximity to spawning gravel are important requirements. Newly emerged fry and juveniles of all species require rearing habitat with low velocities, open cobble substrate, and cool water temperatures. Emigration of smolts to the ocean and the immigration of spawning adults require adequately timed flows with the appropriate temperature, depth, and velocity.

Some of the most important life history and habitat requirements of these species and the spawning populations within species are summarized in Table A-1.

TABLE A-1
LIFE HISTORY AND HABITAT NEEDS FOR ANADROMOUS SALMONID FISH
IN THE TRINITY RIVER BASIN

Species	Migration	Spawning	Rearing	Rearing Habitat Conditions
Spring-run Chinook	Spring - Summer	September - November	Winter - Spring - Summer	Shallow, slow-moving waters adjacent to higher water velocities for feeding.
Fall-run Chinook	Fall	October - December	Winter - Spring	Shallow, slow-moving waters adjacent to higher water velocities for feeding.
Winter-run Steelhead	Winter	February - April	Year-round	Areas of clean cobble where there is refuge from high velocities; juveniles over-winter for 1-2 or more years.
Summer-run Steelhead	Spring - Summer	December - April	Year-round	Areas of clean cobble where there is refuge from high velocities; juveniles over-winter for 1-2 or more years.
Fall-run Steelhead (includes 'half-pounder' life history)	Late-summer/Fall	December - April	Year-round	Areas of clean cobble where there is refuge from high velocities; juveniles over-winter for 1-2 or more years.
Coho	October - December	November - January	Year-round	Backwater areas of slow water and pool margins; juveniles over-winter 1 year.

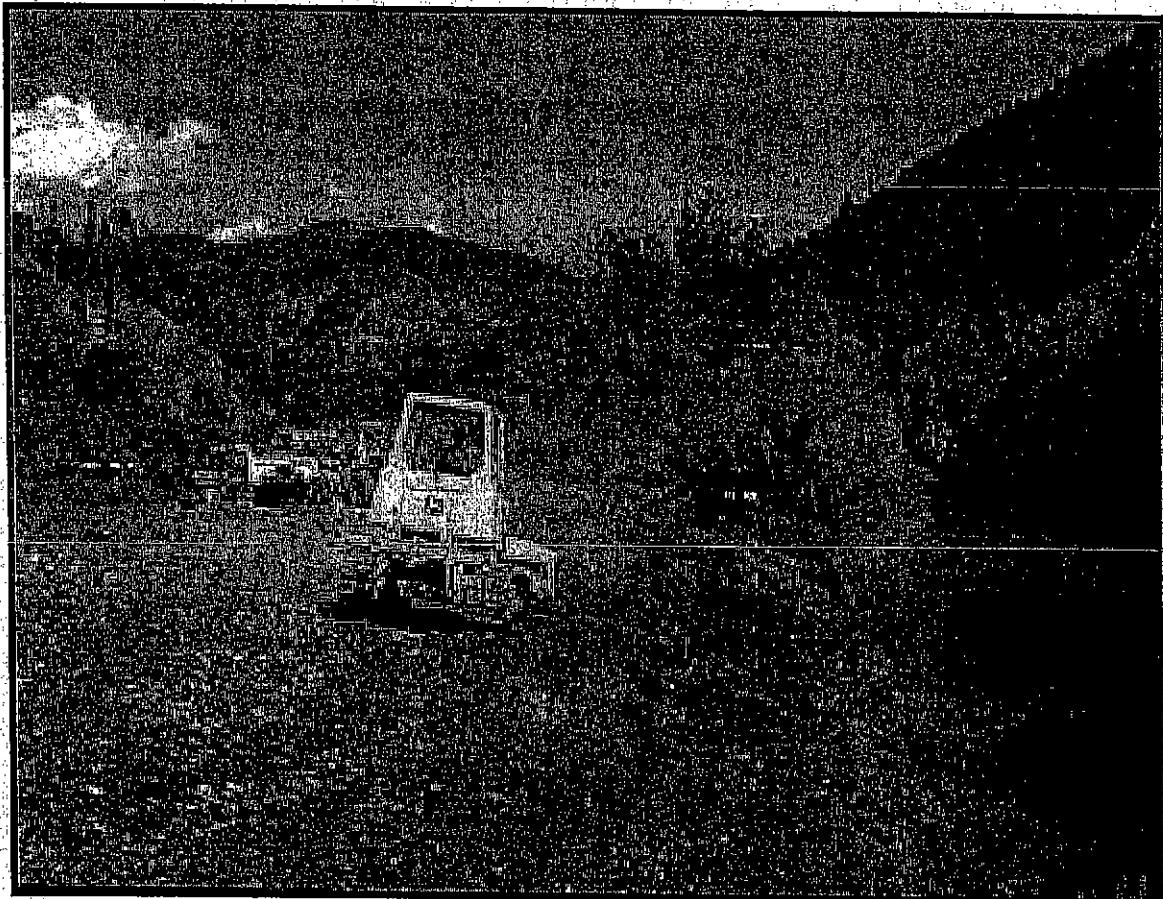
Source: Leidy and Leidy 1984; USFWS et al. 2000a

Historical Restoration Efforts

Following its initial authorization in 1984, the Trinity River Basin Fish and Wildlife Restoration Program conducted a variety of restoration activities in the mainstem Trinity River and its tributaries. Some activities conducted in tributaries include watershed restoration work, as well as habitat enhancement projects, and dam construction and pool dredging in Grass Valley Creek to decrease the amount of fine sediment entering the mainstem Trinity River. Mainstem restoration activities included gravel placement, pool dredging, and construction of several channel rehabilitation projects (side channels and bank rehabilitation of point bars).

From 1990-1993, 27 channel rehabilitation projects were constructed on the mainstem Trinity River between Lewiston Dam and the North Fork, including 18 side-channel projects and nine bank rehabilitation projects (previously known as feathered-edge

projects). The nine bank rehabilitation projects between Lewiston Dam and the North Fork were constructed by physically removing vegetated sand berms along the bank to restore the channel to a pre-dam configuration, i.e., wider and shallower. Along with promoting formation of alluvial features characteristic of unregulated rivers, channel rehabilitation projects have been shown to increase the amount and diversity of habitat for adult and juvenile salmon and steelhead.



**Appendix B – Management Targets, Purpose, and Benefits
By Water Year Type**

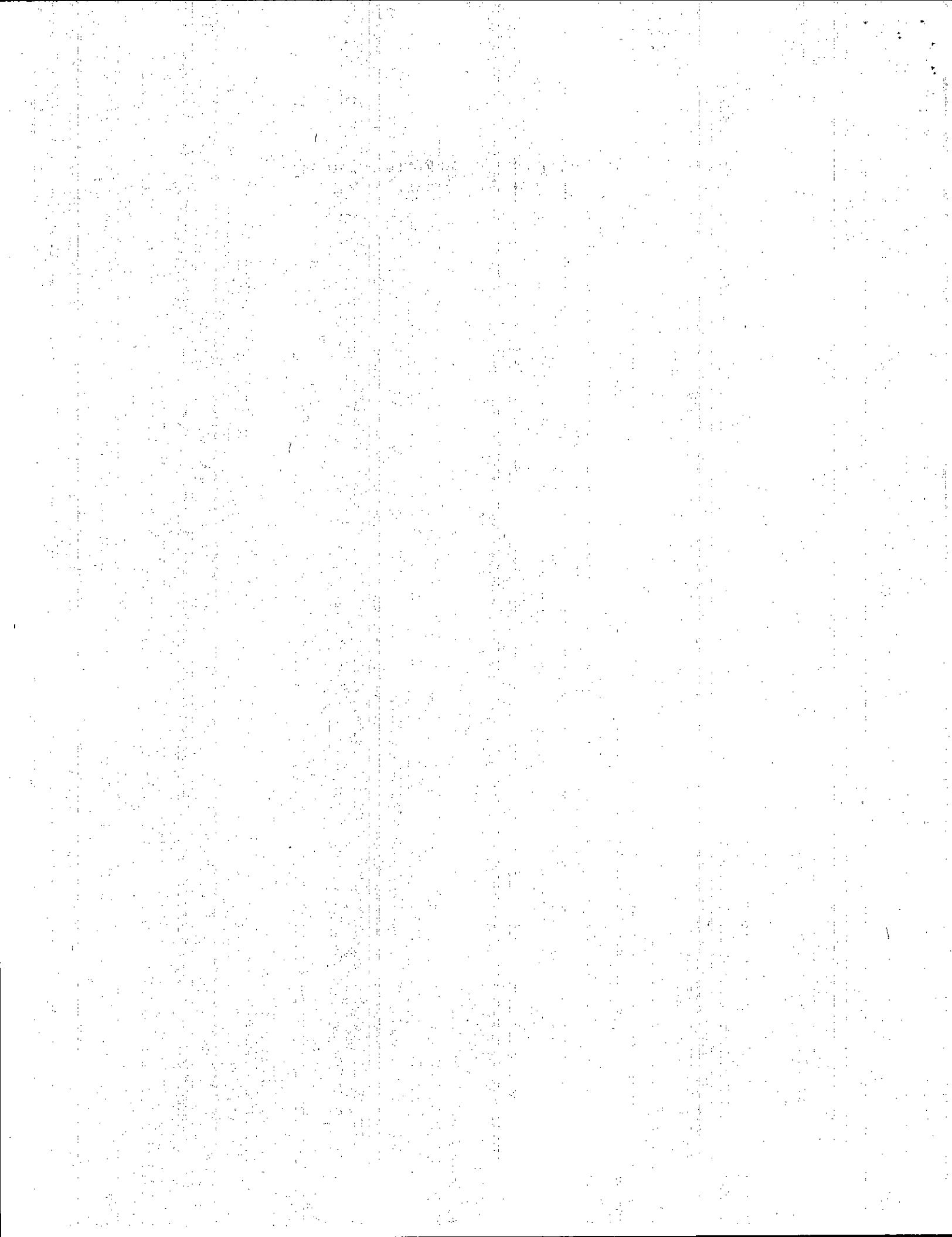


Table 8.5. Recommended releases from Lewiston Dam with management targets, purpose, and benefits during an Extremely Wet water year.

Date	Release (cfs)	Hydrograph Component	Management Target	Purpose	Benefits
Oct 1 - Oct 15	450	Fall baseflow	$\leq 56^{\circ}\text{F}$ at confluence of the North Fork Trinity River.	Provide optimal holding/spawning temperatures for spring- and fall-run chinook adults.	Provide suitable temperatures, reducing pre-spawning mortality and increasing egg viability
Oct 16 - Apr 21	300	Winter baseflow	Provide maximum amount of spawning habitat	Provide best balance of spawning and rearing habitats for all anadromous salmonids in the existing channel	Increase spawning and rearing habitat while minimizing dewatering of redds (dewater less than 5% of redds) of salmonids
Apr 22 - Apr 28	500	Spring baseflow	$\leq 55.4^{\circ}\text{F}$ at Witchpec	Provide optimal temperatures for survival of steelhead smolts	Improve steelhead smolt production
Apr 29 - May 5	1,500	Spring baseflow/ Ascending limb	$\leq 55.4^{\circ}\text{F}$ at Witchpec	Provide optimal temperatures for survival of steelhead smolts	Improve steelhead smolt production
May 6 - May 19	2,000	Spring baseflow/ Ascending limb	$\leq 55.4^{\circ}\text{F}$ at Witchpec	Provide optimal temperatures for survival of steelhead smolts	Improve steelhead smolt production
May 19 - May 24	2,000 - 11,000	Ascending limb	Reach peak flow	Ramp to peak flow (according to OCAP), safely for human use	Reduce travel time of outmigrating steelhead smolts
May 24 - May 28	11,000	Snowmelt peak	Peak: Mobilize $\geq 2\text{ D}_{\text{sc}}$ deep on flanks of alternate bars (more on lower channel than upper) cleanses gravels and transports all sizes of sediments	Reduce fine sediment ($<5/16$ inch) storage within the surface and subsurface channel bed	Increase fry production through improved egg-to-emergence success
			Initiate channel migration at bank rehabilitation sites	Increase sinuosity through channel migration	Increase fry production by creating and maintaining rearing habitat along channel margins
			Duration: Transport coarse sediment ($>5/16$ inch) through mainstem at a rate equal to the tributary input downstream of Rush Creek	Create and maintain alternate bar morphology	Increase smolt production by increasing year-round rearing habitat quality and quantity, and reducing outmigration travel time
			Transport fine sediment ($<5/16$ inch) through mainstem at a rate greater than tributary input (as measured at Limerkin Gutch Gauging Station)	Encourage establishment and growth of riparian vegetation on floodplains	Increase species and age diversity of riparian vegetation
					Scour up to 3 yr old woody riparian vegetation along low flow channel margins and scour younger plants higher on bar flanks

Table 8.5. Continued.

Date	Release (cfs)	Hydrograph Component	Management Target	Purpose	Benefits
May 28 - Jun 6	11,000 - 6,000	Descending limb	Ramp to 6,000 cfs	Reduce fine sediment (<5/16 inch) storage within surface channelled	Increase fry production through improved egg-to-emergence success
Jun 6 - Jun 10	6,000	Descending limb bench	Transport fine sediment (<5/16 inch) through mainstem at a rate greater than tributary input (as measured at Linnekin Gulch Gaging Station)	Reduce fine sediment (<5/16 inch) storage within surface channelled while minimizing coarse sediment (>5/16 inch) transport	Improve fry production through improved egg-to-emergence success Discourage riparian vegetation initiation along low water channel margins
Jun 10 - Jun 30	6,000 - 2,000	Descending limb	Descend at a rate mimicking pre-TRD descent	Inundate point bars Minimize river stage change to preserve egg masses of yellow legged frogs Maintain seasonally variable water surface levels in side channels and off-channel wetlands	Prevent riparian vegetation initiation along low water channel margins Reduce fine sediment (<5/16 inch) storage within surface channelled Improve juvenile chinook salmon growth Increase riparian vegetation and future LWD recruitment
Jul 9 - Jul 22	2,000 - 450	Descending limb	Provide optimal water temperatures ($\leq 62.6^{\circ}$ F) to Weitchpec for chinook salmon smolts	Provide optimal temperatures for increased survival of chinook smolts Inundate point bars Minimize stranding of salmonid fry behind berms	Improve chinook smolt production Prevent riparian initiation along low water channel margins Increase survival of steelhead fry
Jul 22 - Sep 30	450	Summer baseflow	Decline to summer baseflow	Provide water temperatures $\leq 60^{\circ}$ F to Douglas City through Sep 14 Provide water temperatures $\leq 56^{\circ}$ F to Douglas City from Sep 15 through Sep 30	Provide outmigration cues for chinook smolts Increase production of coho salmon and steelhead by providing water temperatures conducive to growth

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Table 8.6. Recommended releases from Lewiston Dam with management targets, purpose, and benefits during a Wet water year.

Date	Release (cfs)	Hydrograph Component	Management Target	Purpose	Benefits
Oct 1 - Oct 15	450	Fall baseflow	$\leq 56^{\circ}\text{F}$ at confluence of the North Fork Trinity River	Provide optimal holding/spawning temperatures for spring- and fall-run chinook adults	Provide suitable temperatures, reducing pre-spawning mortality and increasing egg viability
Oct 16 - Apr 21	300	Winter baseflow	Provide maximum amount of spawning habitat	Provide best balance of spawning and rearing habitats for all anadromous salmonids in the existing channel	Increase spawning and rearing habitat while minimizing devastating effects of redds (dewater less than 5% of redds) of salmonids
Apr 22 - Apr 28	500	Spring baseflow	$\leq 55.4^{\circ}\text{F}$ to Weitchpec	Provide optimal temperatures for survival of steelhead smolts	Improve steelhead smolt production
Apr 29 - May 5	2,000	Spring baseflow/ Ascending limb	$\leq 55.4^{\circ}\text{F}$ to Weitchpec	Provide optimal temperatures for survival of steelhead smolts	Improve steelhead smolt production
May 6 - May 13	2,500	Spring baseflow/ Ascending limb	$\leq 55.4^{\circ}\text{F}$ to Weitchpec	Provide optimal temperatures for survival of steelhead smolts	Improve steelhead smolt production
May 13 - May 17	2,500 - 8,500	Ascending limb	Reach peak flow	Ramp to peak flow (according to OCAP) safely for human use.	Reduce travel time of outmigrating steelhead smolts
May 17 - May 21	8,500	Showmelt peak	Peak Threshold : Mobilize $\geq D_*$ deep on flanks of alternate bars (more on lower channel than on upper)	Reduce fine sediment ($<5/16$ inch) storage within surface and subsurface channelled	Reduce fine sediment through improved egg-to-emergence success
			cleanses gravel and transports all sizes of sediments	Increase sinuosity through channel migration	Increase fry production by creating and maintaining rearing habitat along channel margins
			Initiate channel migration at bank rehabilitation sites	Create and maintain alternate bar morphology	Increase smolt production by increasing year-round habitat quality and quantity and reducing outmigration travel time
			Duration: Transport coarse sediment ($>5/16$ inch) through mainstem at a rate equal to tributary input downstream of Rush Creek	Encourage establishment and growth of riparian vegetation on floodplains	Increase species and age diversity of riparian vegetation
			Transport fine sediment ($<5/16$ inch) through mainstem at a rate greater than tributary input (as measured at Limekiln Gulch Gaging Station)	Scour up to 2 yr old woody riparian vegetation along low flow channel margins	

CHAPTER 8: RECOMMENDATIONS

Table 8.6. Continued.

Date	Release (cfs)	Hydrograph Component	Management Target	Purpose	Benefits
May 21	8,500 - 6,000	Descending limb	Ramp to 6,000 cfs	Reduce fine sediment (<5/16 inch) storage within surface channelled	Increase fry production through improved egg-to-emergence success
May 24	6,000	Descending limb	Transport fine sediment (<5/16 inch) through mainstem at a rate greater than tributary input (as measured at Lamekuk Gulch Gaging Station)	Reduce fine sediment (<5/16 inch) storage within surface channelled while minimizing coarse sediment (>5/16 inch) transport	Increase fry production through improved egg-to-emergence success
May 24 - May 28	6,000	Descending limb bench			Discourage riparian vegetation initiation along low water channel margins
May 28 - Jun 14	6,000 - 2,000	Descending limb	Descend at a rate mimicking pre-FRD descent.	Inundate point bars	Prevent riparian vegetation initiation along low water channel margins
			Descend at a rate less than 0.1 ft/day	Minimize river stage change to preserve egg masses of yellow legged frogs	Reduce fine sediment (<5/16 inch) storage within surface channelled
Jun 14 - Jul 9	2,000	Descending limb bench		Maintain seasonally variable water surface levels in side channels and off-channel wetlands	Improve juvenile chinook salmon growth
Jul 9 - Jul 22	2,000 - 450	Descending limb	Provide optimal water temperatures ($\leq 62.6^{\circ}$ F) to Weitchpec for chinook salmon smolts	Provide optimal temperatures for increased survival of chinook smolts	Improve chinook smolt production
Jul 22 - Sep 30	450	Summer baseflow	Decline to summer baseflow	Inundate point bars	Prevent riparian initiation along low water channel margins
				Minimize stranding of salmonid fry behind berms	Increase survival of steelhead fry
					Provide outmigration cues for chinook smolts
					Increase production of coho salmon and steelhead by providing water temperatures conducive to growth

Table 8.7. Recommended releases from Lewiston Dam with management targets, purpose, and benefits during a Normal water year.

Date	Release (cfs)	Hydrograph Component	Management Target	Purpose	Benefits
Oct 1 - Oct 15	450	Fall baseflow	$\leq 56^{\circ}\text{F}$ at confluence of the North Fork Trinity River	Provide optimal holding/spawning temperatures for spring- and fall-run chinook adults	Provide suitable temperatures, reducing pre-spawning mortality and increasing egg viability
Oct 16 - Apr 21	300	Winter baseflow	Provide maximum amount of spawning habitat	Provide best balance of spawning and rearing habitats for all anadromous salmonids in the existing channel	Increase spawning and rearing habitat while minimizing dewatering of redds (dewater less than 5% of redds) of salmonids
Apr 22 - Apr 28	500	Spring baseflow	$\leq 55.4^{\circ}\text{F}$ at Witchipee	Provide optimal temperatures for enhanced survival of steelhead smolts	Improve steelhead smolt production
Apr 29 - May 5	2,500	Spring baseflow/ Ascending limb	$\leq 55.4^{\circ}\text{F}$ at Witchipee	Provide optimal temperatures for enhanced survival of steelhead smolts	Improve steelhead smolt production
May 5 - May 7	2,500 - 6,000	Ascending limb	Reach peak flow	Ramp to peak flow (according to OCAP) safely for human use	Reduce travel time of outmigrating steelhead smolts
May 7 - May 11	6,000	Snowmelt peak	Peak Threshold: Mobilize D ₅₀ on most alluvial features (general channel mobility)	Provide optimal temperatures for survival of steelhead smolts	Improve steelhead smolt production
			Duration: Transport coarse sediment ($>5/16$ inch) through mainstem at a rate equal to the tributary input downstream of Rush Creek	Reduce fine sediment ($<5/16$ inch) storage within the surface channel bed	Increase fry production through improved egg-to-emergence success
			Transport fine sediment ($<5/16$ inch) through mainstem at a rate greater than tributary input (as measured at Linnekin Gulch Gaging Station)	Create and maintain alternate bar morphology Create floodplains by bar building and fine sediment deposition Encourage establishment and growth of riparian vegetation on floodplains Scour up to 1 yr old woody riparian vegetation along channel margins	Discourage riparian vegetation initiation along low water channel margins Increase smolt production by increasing year-round rearing habitat quality and quantity, and reducing outmigration transport time

Table 8.7. Continued.

Date	Release (cfs)	Hydrograph Component	Management Target	Purpose	Benefits	
May 11 - Jun 10	6,000 - 2,000	Descending limb descent	Descend at a rate mimicking pre-TRD	Inundate point bars to prevent riparian initiation and encroachment along channel margins	Reduce fine sediment (<5/16 inch) storage within surface channelled	
			Descend at a rate less than 0.1 ft/day	Minimize river stage change to preserve egg masses of yellow legged frogs	Improve juvenile chinook growth	
				Maintain seasonal variation of water surface levels in side channels and off-channel wetlands	Increase riparian vegetation and future LWD recruitment	
Jun 10 - Jul 9	2,000	Descending limb bench	Provide optimal water temperatures ($\leq 62.6^{\circ}\text{ F}$) to Wetchipee for chinook salmon smolts	Provide optimal water temperatures for survival of chinook salmon smolts	Improve chinook smolt production	
Jul 9 - Jul 22	2,000 - 450	Descending limb	Decline to summer baseflow	Inundate point bars to prevent riparian initiation along channel margins	Prevent riparian initiation along channel margin	
Jul 22 - Sep 30	450	Summer baseflow	Provide water temperatures $\leq 60^{\circ}\text{ F}$ to Douglas City through Sep 14	Provide water temperatures $\leq 60^{\circ}\text{ F}$ to Douglas City from Sep 15 through Sep 30	Increase survival of holding adult spring-run chinook by providing optimal thermal refugia	
					Provide water temperatures $\leq 56^{\circ}\text{ F}$ to Douglas City from Sep 15 through Sep 30	Increase production of coho salmon and steelhead by providing water temperatures conducive to growth

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Table 8.8. Recommended releases from Lewiston Dam with management targets, purpose, and benefits during a dry water year.

Date	Release (cfs)	Hydrograph Component	Management Target	Purpose	Benefits
Oct 1 - Oct 15	450	Fall baseflow	$\leq 56^{\circ}\text{ F}$ at confluence of the North Fork Trinity River	Provide optimal holding/spawning temperatures for spring- and fall-run chinook adults	Provide suitable temperatures, reducing pre-spawning mortality and increasing egg viability
Oct 16 - Apr 26	300	Winter baseflow	Provide maximum amount of spawning habitat	Provide best balance of spawning and rearing habitats for all anadromous salmonids in the existing channel	Increase spawning and rearing habitat while minimizing dewatering of redds (dewater less than 5% of redds) of salmonids
Apr 26 - May 1	300 - 4,500	Ascending limb	Reach peak flow	Ramp to peak flow (according to OCAP) safely for human use	Reduce travel time of outmigrating steelhead smolts
May 1 - May 5	4,500	Peak flow	Peak Threshold: Mobilize D ₄ on bar banks features (median bars, pool tails)	Reduce fine sediment ($<5/16$ inch) storage within surface channelled	Increase salmonid fry production through improved egg-to-emergence success
			Duration: Transport coarse sediment ($>5/16$ inch) through mainstem at a rate equal to the tributary input downstream of Rush Creek		Discourage riparian vegetation initiation along low flow channel margins
			Transport fine sediment ($<5/16$ inch) through mainstem at a rate greater than tributary input (- as measured at Limestone Gulch Gaging Station)		
May 5 - Jun 26	4,500 - 450	Descending limb	Descend at a rate mimicking pre-TRD descent	Imitate point bars	Prevent riparian initiation along channel margins
			Provide non-lethal water temperatures to Weitchpec for coho smolts ($\leq 52.6^{\circ}\text{ F}$) until June 4, and for chinook smolts ($\leq 66^{\circ}\text{ F}$) until mid-June	Minimize river stage change to preserve egg masses of yellow legged frogs	Reduce fine sediment ($<5/16$ inch) storage within surface channelled
				Maintain seasonal variation of water surface levels in side channels and off-channel wetlands	Improve juvenile chinook growth
				Improve salmonid smolt production by providing temperatures necessary for survival of steelhead, coho, chinook smolts	Increase survival of steelhead fry
Jun 26 - Sep 30	450	Summer baseflow	Provide water temperatures $\leq 60^{\circ}\text{ F}$ to Douglas City through Sep 14	Increase survival of holding adult spring-run chinook by providing optimal thermal refugia	Provide outmigration cues for chinook salmon smolts
			Provide water temperatures $\leq 56^{\circ}\text{ F}$ to Douglas City from Sep 15 through Sep 30		Increase production of coho salmon and steelhead by providing water temperatures conducive to growth

Table 8.9. Recommended releases from Lewiston Dam with management targets, purpose, and benefits during a Critically Dry water year.

Date	Release (cfs)	Hydrograph Component	Management Target	Purpose	Benefits
Oct 1 - Oct 15	450	Fall baseflow	$\leq 56^{\circ}$ F at confluence of the North Fork Trinity River	Provide optimal holding/spawning temperatures for spring- and fall-run chinook adults	Provide suitable temperatures; reducing pre-spawning mortality and increasing egg viability
Oct 16 - Apr 22	300	Winter baseflow	Provide maximum amount of spawning habitat	Provide best balance of spawning and rearing habitats for all anadromous salmonids in the existing channel	Increase spawning and rearing habitat while minimizing dewatering of redds (dewater less than 5% of redds) of salmonids
Apr 22 - Apr 24	300 - 1,500	Ascending limb	Reach peak flow	Ramp to peak flow (according to OCAP) safely for human use	Reduce travel time of outmigrating steelhead smolts
Apr 24 - Apr 29	1,500	Peak flow	Provide non-lethal water temperatures to Weitchpec for steelhead smolts ($\leq 55^{\circ}$ F) until May 22, and for coho salmon smolts ($\leq 62.6^{\circ}$ F) until May 29	Sustain steelhead and coho salmon smolt production by providing non-lethal temperatures for survival	Transport limited amounts of surface fine sediment ($<5/16$ inch)
May 19 - Jun 26	1,500 - 450	Descending limb	Inundate bar banks (1,500 cfs)	Discourage riparian vegetation establishment along channel margins	Prevent riparian initiation along low water channel margins
Jun 26 - Sep 30	450	Summer baseflow	Descend at a rate mimicking pre-TRD descent	Minimize river stage change to preserve egg masses of yellow legged frogs	Reduce fine sediment ($<5/16$ inch) storage within surface channelled
				Inundate point bars	Maintain seasonal variable water surface levels in side-channel and off-channel wetlands
				Provide non-lethal water temperatures to Weitchpec for coho smolts ($\leq 62.6^{\circ}$ F) until June 4, and for chinook smolts ($\leq 68^{\circ}$ F) until mid-June	Sustain/ improve salmonid smolt production
					Provide outmigration cues for chinook salmon smolts
					Increase production of coho salmon and steelhead by providing water temperatures conducive to growth